Restore Mission

Statement of Work for the Vision Sensor Subsystem Camera

Goddard Space Flight Center
Greenbelt, Maryland

CM FOREWORD

This document is a RESTORE Project controlled document. Changes to this document require prior approval of the RESTORE Project CCB Chairperson. Proposed changes shall be submitted to the RESTORE Project Configuration Management Office (CMO), along with supportive material justifying the proposed change.

Questions or comments concerning this document should be addressed to:

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Statement of Work for the VSS Camera for the Restore

DOCUMENT CHANGE RECORD

REV/ VER LEVEL	DESCRIPTION OF CHANGE	APPROVED BY	DATE APPROVED
-	Baseline Release of Document		

Statement of Work for RESTORE Project
VSS Camera

RECORD OF WAIVERS

APPLICABLE SECTION	DESCRIPTION OF WAIVER

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1 Introduction

1.1 General Information

The Satellite Servicing Capabilities Office (SSCO) was established in 2009 to continue NASA's 40-year legacy of satellite servicing and repair. Among its various pursuits, SSCO has conducted a detailed engineering study of a notional mission: a free flying satellite with advanced robotics to perform refueling and other servicing. Restore is the internal name for this design reference mission.

The Restore mission is a free-flying mission to be launched in 2018 conducted with a U.S. industry partner to initiate on-orbit satellite servicing to operational legacy Government and commercial satellites. Notional operational locations include, Geosynchronous Orbit (GEO), Low Earth Orbit (LEO) and interplanetary environments (2 AU).

This document defines the work to be performed for Contractor design, development, fabrication, and delivery of the Restore Vision Sensor Subsystem (VSS) Camera, from here on referred to as the VSS Camera.

The SSCO staff is comprised of federal and contractor staff, any of whom may interface with the Contractor's team.

1.2 General Requirements

The Contractor shall provide the facilities, personnel, services, tools, equipment, and materials necessary to deliver VSS Camera for Restore.

The Contractor shall fabricate, test and deliver the following units of hardware/software:

- Minimum order quantity of three (3) Engineering Model (EM) units, as defined in the accompanying Specification document. The EM camera shall be of the same fit, form and function as a space-capable unit. It shall have the same size, weight and power (SWAP) footprint as the space-capable version. The EM model may use commercial electrical parts throughout its design under the assumption that the commercial parts can be swapped one-for-one with a space-suitable component with no changes required to the camera design. GSFC will waive all environmental testing for the EM units. As such, Section 5.5 of the Specification, with the exception of subsection 5.5.1 and 5.5.2, does not apply.

2 Management, Reporting, Documentation and Reviews

2.1 Applicable Documents

All applicable and reference documentation identified in this document shall apply in the situations where they are specifically referenced. In the event of a conflict between the SOW and the Specification, the SOW shall take precedence. See Appendix C for referenced documents.

2.2 Management and Reporting

The Contractor shall designate a single individual who will be given full responsibility and authority to manage and administer all phases of the work specified by the contract, and ensure that all objectives are accomplished within schedule and cost constraints.

The Contractor shall provide for managing all resources, controlling schedules, managing all engineering, manufacturing and procurement activities, configuration management, Quality Assurance, documentation control, and distribution.

The Contractor shall prepare and present to the NASA/GSFC Technical Representative monthly status via telecon and a written report. The report shall be a summary presentation of the period's progress, problem areas, and activities on-going and planned. The Contractor shall generate a list of significant milestones that will enable NASA/GSFC to ascertain program progress. The designated Contractor point of contact to GSFC will be responsible for scheduling the monthly status telecons with the NASA/GSFC Technical Representative.

3 Notification to NASA/GSFC

The Contractor shall notify the NASA/GSFC Technical Representative at least five (5) calendar days in advance of all mandatory hardware inspections, test activities, and deliveries at either the Contractor’s or a sub-Contractor’s facility to allow timely participation by the NASA/GSFC Quality Assurance activates.

4 Engineering

4.1 General Requirements

The Contractor shall perform analyses of the technical and environmental requirements specified in the Specification document to ensure compliance of the hardware fabrication and to assemble the documentation necessary to ensure its usability by NASA/GSFC users.

4.2 Engineering Documentation

The system engineering analyses of the detailed design and subsequent fabrication and assembly, test, and inspection of the VSS Camera shall result, as a minimum, in the technical

documentation, as required in this SOW and Specification document. Contractor format is suitable for this documentation.

4.2.1 Mechanical and Electrical Hardware Documentation

In addition to any documentation called for in a final contract, NASA/GSFC specifically requires the following documentation in support of the VSS camera hardware build:

- Mechanical:
  - High Fidelity mechanical CAD model for the VSS camera for the as-designed unit with updates provided for the as-built units.
  - A top-level mechanical Interface Control Document (ICD) that details the mechanical properties of the as-built VSS camera.
  - Mechanical assembly drawings showing how the VSS camera is assembled from subassembly and component parts.
  - Mechanical drawings of all subassemblies and individual mechanical components that make up the final as-built VSS camera.
- Electrical:
  - As-designed parts lists for the VSS camera. The list shall include the original equipment manufacturer (OEM) of each part, its corresponding OEM part number, serial number, lot number or any other relevant traceability information.
  - An electrical ICD detailing the electrical interface of the VSS camera. This document shall contain detailed specifications regarding the pin outs of any input / output connectors, the format and structuring of any command / data interfaces, as well as any other pertinent information that GSFC will need to power, control and command the camera. Details on the structure and any status / telemetry packets is also required.

If not included in the above details, the Contractor shall provide a document or documents that define, in detail, all performance, functional, environmental specifications, and all command, data, electrical, and mechanical interfaces.

If not included in the above details, the Contractor shall provide a drawing package that includes, but is not limited to;

- ELECTRICAL: assembly and interface drawings
- MECHANICAL: assembly and interface drawings

4.2.2 Verification

The Contractor shall conduct a verification program that demonstrates the hardware design is qualified and meets all requirements contained in the Specification document.

5 Hardware Manufacture

5.1 General Requirement

The Contractor shall manufacture and test hardware to meet the requirements of the Specification document.

6 Firmware/Software

6.1 Contractor Responsibilities

Contractor will write, manage, and verify software for the EGSE that is required to operate the VSS Camera.

6.2 Functional and Performance Modifications

The Contractor shall provide software modifications as necessary to ensure functionality and performance of the VSS camera throughout the entirety contract phase.

7 Quality Assurance

7.1 General Requirements

The Contractor shall manufacture and test hardware to meet the quality assurance requirements of the Specification document.

8 Contamination Control

The Contractor shall establish the specific cleanliness requirements to minimize performance degradation and delineate the approaches to meet the Restore Project requirements.

8.1 Contamination Control Plan

The Contractor shall submit their CCP, as currently used in their manufacturing facility, to NASA/GSFC for review. Review of the CCP will assist NASA/GSFC evaluation of Contractor facility capabilities for possible future flight unit manufacture.

If data is available, ideally the CCP will:

- Establish the implementation and describe the methods and procedures that will be used to measure and maintain the levels of cleanliness required during each of the various phases of the item's lifetime.
- Describe the contamination potential of material and equipment used in cleaning, handling, packaging, tent enclosures, shipping containers, bagging (e.g., anti-static film materials), and purging in detail at each phase of assembly, integration, and test.
- Define the use of protective covers and purges, vent locations and paths, and environmental constraints.

9 Handling, Storage, Packaging, Preservation, and Delivery

Products shall be stored, preserved, marked, labeled, packaged, and packed to prevent loss of marking, deterioration, contamination, excessive condensation and moisture, or damage during all phases of the program.

Contractor is responsible for providing an acceptable shipping container that protects the hardware appropriately, such as a pelican case or similar container. While in a shipping container, the VSS Camera shall be wrapped in a non-ESD-generating vapor barrier with redundant maximum humidity indicators.

The shipping container shall also include shock and humidity indicators and shall be capable of prolonged shipping conditions. The Contractor shall document what action NASA/GSFC is to take if the sensors are tripped when hardware arrives at the NASA/GSFC receiving area. A copy of this document shall be included with shipping documentation.

The Contractor shall ship Freight On Board (F.O.B.) Greenbelt, Maryland. The Contractor has responsibility for any damage incurred during shipment.

10 Schedule

The Contractor shall furnish and deliver the supplies/documentation and perform the services required by this Statement of Work in accordance with the schedule set forth below:

Item	On or Before
Contractor shall conduct Monthly Status Meeting/Reports.	Beginning one (1) month from ARO and continuing until delivery of unit
Contractor delivers minimum order quantity of two (3) Engineering Model (EM) VSS Cameras	No later than April 30th, 2015 if possible

11 APPENDIX A: Abbreviations and Acronyms

ABBREVIATION/ ACRONYM	DEFINITION
ANSI	American National Standards Institute
ATP	Acceptance Test Procedure
BBU	Breadboard Unit
BSP	Board Support Package
C&DH	Command and Data Handling
CCP	Configuration Control Plan
CDR	Critical Design Review
CM	Configuration Management
CO	Contracting Officer
TECHNICAL REPRESENTATIVE	Contracting Officer Technical Representative
CVCM	Collected Volatile Condensable Mass
DPA	Destructive Physical Analysis
ESD	Electrostatic-Discharge
FMEA	Failure Modes and Effects Analysis
FRB	Failure Review Board
GEO	Geosynchronous Orbit
GSE	Ground Support Equipment
GSFC	Goddard Space Flight Center
ICD	Interface Control Document
LEO	Low Earth Orbit
MIP	Mandatory Inspection Point
MRB	Material Review Board
MUA	Materials Usage Agreement
PEMs	Plastic Encapsulated Microcircuits
PER	Pre-Environmental Review
PIL	Parts Identification List
PIND	Particle Impact Noise Detection
PSR	Pre-Ship Review
PWB	Printed Wiring Board
QA	Quality Assurance
QCM	Quartz Crystal Microbalance
ROM	Read-Only Memory
SCC	Stress Corrosion Cracking
SCM	Software Configuration Management
S/C	Spacecraft
SEE	Single-Event Effects
SOW	Statement of Work
SUROM	Startup Read-Only Memory
TML	Total Mass Loss
TID	Total Ionizing Dose
TIM	Technical Interchange Meeting
TPL	Trended Parameters List
TQCM	Thermal Quartz Crystal Microbalance
VSS	Vision Sensor Subsystem
WVR	Waiver

12 APPENDIX B: Restore Material Usage Agreement Form

MATERIAL USAGE AGREEMENT (MUA)		USAGE AGREEMENT NO.:		PAGE OF
PROJECT:	:	ORIGINATOR:		ORGANIZATION:
DETAIL DRAWING	NOMENCLATURE	USING ASSEMBLY	NOMENCLATURE	
MATERIAL & SPECIFICATION		MANUFACTURER & TRADE NAME		
USAGE	THICKNESS	WEIGHT	EXPOSED AREA	ENVIRONMENT
				PRESSURE / TEMPERATURE / MEDIA
APPLICATION:				
RATIONALE:				
ORIGINATOR:		PROJECT MANAGER:		DATE:

13 APPENDIX C: List of Referenced Documents

All referenced documentation identified in the SOW shall apply in the situations where they are specifically referenced.

DOCUMENT NUMBER	TITLE	Revision/Date
RESTORE-SPEC-001394	Performance Specification: Restore VSS Camera	10/22/14
541-PG-8072.1.2	GSFC Fastener Integrity Requirements	03/05/01
ANSI/ASQ9001-2000	Model for Quality Assurance Design, Development, Production, Installation, and Servicing	8/91
NASA-STD-8739.7	Electrostatic Discharge Control	12/15/97
NASA-STD-8739.3	Requirements for Soldered Electrical Connections	12/15/97
NASA-STD-8739.4	Requirements for Crimping Inter-connecting Cables, Harnesses, and Wiring	02/09/98
NASA-STD-8739.2	Workmanship Standard for Surface Mount Technology	08/31/99
NASA-STD-8739.1	Workmanship Standard for Staking and Conformal Coating of Printed Wiring Boards and Electronic Assemblies	08/06/99
S312-P-003	Procurement Specification for Rigid Printed Boards for Space Flight Applications and Other High Reliability Uses	07/16/97 Revision B
EEE-INST-002	Instructions for EEE Parts Selection, Screening, Qualification, and Derating	05/01/03
IPC-D-275	Design Standard for Rigid Printed Boards and Rigid Printed Board Assemblies	09/30/91
IPC-2223	Sectional Design Standard for Flexible Printed Boards	11/01/98
IPC-2222	Sectional Design Standard for Rigid Organic Printed Boards	02/01/98
IPC-2221	Generic Standard on Printed Board Design	05/01/03 Revision A

IPC-A-600	Acceptability of Printed Boards	11/01/99 Revision F
IPC-6011	Generic Performance Specification for Printed Boards	07/01/96
IPC-6012	Qualification and Performance Specification for Rigid Printed Boards	07/01/00 Revision A
IPC-6013	Qualification and Performance Specification for Flexible Printed Boards	11/01/98
S-311-M-70	Destructive Physical Analysis. Equivalent	01/07/91
NASA-STD-6001	Flammability, odor, off-gassing and compatibility requirements & test procedures for materials in environments that support combustion	02/09/98
MIL-STD-1629	Procedures for Performing an FMEA	Revision A
MSFC-STD-3029	Multiprogram/project common-use document guidelines for the selection of metallic materials for stress corrosion cracking resistance in sodium chloride environments	05/22/00
ASTM E-595	Standard test method for total mass loss and collected volatile condensable materials from outgassing in a vacuum environment	10/01/03
NASA Reference Publication 1124	Outgassing Data for Selecting Spacecraft Materials	09/01/03
MIL-HDBK-217	Reliability Modeling and Prediction	Revision F